

Notes
ON
the use of Prickly-pear as Fodder.



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Notes on the use of Prickly-pear as Fodder.

The following instructions have been prepared by Professor J. B. Knight and Mr. A. M. Macmillan, P. A. to the Collector, Poona, on the results of experience gained in the last 10 years and especially this year in the Nagar and Poona Districts and at the Agricultural College.

They are printed not as the final results of this experience but provisionally as a guide to officers who wish to start prickly-pear fodder work at once and to have information as to the methods which can be adopted and recommended for adoption by cultivators with full confidence.

They are intended to supersede those issued by the Collector of Poona on 29th January 1919.

About a dozen types of lamp, an equal number of designs of hearth and all the available kinds of blower have been tried.

No details are given as to their relative merits and defects in this pamphlet. Only the equipment and implements which have been found best are described and it is recommended that these should be made and used exactly as described until in the course of working some other form is found to be better.

Many of the details given may seem trivial but economy in fuel, labour and equipment depends entirely on these. The use of badly made or too small tongs, e.g., may very easily halve the output of a hearth. A well trained lamp burner using the lamp flame exactly in the manner described can turn out four times as much pear as a beginner.

In a district where no work has so far been done it is recommended that, to begin with, a complete equipment should be obtained from the Agricultural College, Poona, although the prices charged are probably much higher than local prices for similar articles.

Use as Fodder.

Prickly-pear can be rendered fit for use as cattle fodder by removing, destroying or rendering harmless the large thorns and the small tufts of fine hairlike thorns at their roots. The roots of these groups of thorns in the leaves are very shallow. The whole of the system can be completely removed by cutting less than $\frac{1}{2}$ inch below the surface.

The methods which have been adopted for preparing prickly-pear for use as fodder are as follows:—

(1) Removing the thorns completely by cutting them out with a knife or gouge or specially shaped pincers.

The quickest way is to cut round the edge of each leaf first. This removes the majority of the thorns. The rest, perhaps a dozen on each side have then to be removed one by one.

The method at best is slow and laborious. It is very liable to be done carelessly and large quantities of the fine thorns are left sticking to the leaves and the operator's hands.

Enough prickly-pear for two cattle can be prepared by one person in a day. The method has been used widely in Madras and the S. M. C. in previous famines.

(2) Steaming the prickly-pear in a specially prepared boiler to soften the thorns and render them harmless.

This method is said to be used in Australia but has not been tried with any success in India.

(3) Ensilage.

The prickly-pear is packed in silo without any preparation and left for a long period. It turns into a mass which is cut up and used for feeding bullocks, milch cattle and horses.

This is said to be done extensively in South Africa, but has never been tried out in India.

(4) Burning the thorns off—

- (a) Burning the standing pear by heaping rubbish round it and setting fire to it.
- (b) Burning the standing pear with large petrol or kerosene torches (used in Texas).
- (c) Cutting down the pear in branches and burning over a fire of brushwood and rubbish.
- (d) Cutting down and hanging up branches and burning with hand blow lamps (kerosene or petrol).
- (e) Cutting down and burning in small branches over a blown fire of coke charcoal or light dry wood.

Of all those methods the only ones which have been thoroughly tried out, tested and found to be safe, effective and economical in India are the last two (d) and (e).

Burning with blow lamps was introduced by Rev. A. Norton of Dhond in 1907 and has been used by him in every year of scarcity since then. It was used in Nagar district in the fodder famine of 1911 and was made the subject of a thorough and prolonged test at the Agricultural Dairy Farm at Kirkee in 1913.

It has been used on a large scale during the current year in Ahmednagar and Poona districts.

The method of burning over a fire of dry wood with an air blast supplied by an ordinary blacksmith's double bellows, *ghisadi*'s double skin bellows, or rotary blower has been developed this season by Mr. Beyts in Nagar and at the Agricultural College at Poona.

As almost every detail of these two methods has been thoroughly worked out and tested, they alone are recommended for adoption although it is quite possible that others may, after trial, be found to be equally good or better, under certain conditions.

Value as Fodder.

Prickly-pear when properly prepared produces no injurious effect whatever when used as fodder. It has about the same food value as $\frac{1}{4}$ the weight of dry *kadba*. Combined with about 6 per cent. of its weight of cotton seed it forms a complete and sufficient diet for cattle.

It can probably be used after drying like other fodders; but sufficient experience has not yet been gained to justify any recommendation as to its preparation and use. It is being experimented with in Poona and any definite results will be published later.

Habituation of Cattle.

Very few animals will take readily to prickly-pear unless they are starved. They must be trained and the training may require considerable patience and care. There are two methods—

(1) To mix a gradually increasing amount of prickly-pear so intimately with the animal's ordinary fodder grass or *kadbi* or cotton seed that it cannot separate the two. The method is used at Kirkee.

(2) To starve the animal completely putting nothing before it except fresh prickly-pear rubbed over with *atta* or *sarki* and perhaps a little finely

ground salt or sweet oil and giving it nothing but a little water. It will very soon under this treatment begin to eat the prickly-pear and once it has begun it will soon eat freely.

About five pounds covered with bran or *atta* or *sarki* should be placed before the animal. If it does not eat within six hours this should be taken away and a fresh lot put before it, and so the following day and every day till it begins to eat.

As a matter of fact at present a large proportion of the cattle are already half starved and it takes a very little covering of *atta* to induce them to eat the pear straight off.

Note also that if one animal begins to eat, very often the others with it will follow its example and it is a good thing to tie up an animal already trained where other animals are being taught for the first time.

Effects of Feeding.

1. As the pear contains a great deal of water, animals fed on it require very little water to drink. If they are given a little salt however they drink an ordinary amount, but it is not at all necessary to get them to drink as usual in this way.

2. The dung of cattle fed on pear is thinner and of a much darker colour than that of animals fed on grass or *kadba*.

3. Sometimes cattle suffer from diarrhoea on this diet. If this happens they should be given either dry fodder like grass alone or a mixture of grass and pear till they get back to normal.

4. If an animal begins to show signs like those of dysentery with blood in the dung it probably means that it has been fed with pear carelessly prepared and insufficiently burned, and it should be put on a diet of grass or cotton seed alone for a time.

5. Some animals thrive on the diet at once, but, as a rule, they at first for a week or two go back in condition and then begin to improve.

6. If an animal is already very weak and exhausted from starvation it may be too far gone to be able to recover *either on grass or prickly-pear*. Starting to feed on prickly-pear will not save all animals which are dying of starvation.

7. So far as it has been tried, changing a cow from grass to prickly-pear fodder does not affect its yield of milk in any way; but the experiment has never been tried over a very long period.

At Kirkee in 1913, 19 cows and 19 buffaloes were fed partly on prickly-pear for some weeks and it neither increased nor decreased the supply of milk, nor did it alter the quality.

Of course milch cattle need some food like *sarki* with prickly-pear.

Cutting.

The implement which has been found to be most effective is that shown in the plate.

The best method of using is to cut upwards between the first and second joint of the branch, as the branch is softer there than at the root, and there is less chance of the cutter sticking or of the whole bush being uprooted.

If the pear is to be removed with a cart, each branch as it is cut is thrown behind with the cutter and then loaded onto the cart with the pitchfork shown in the plate.

If the pear is not to be carried far, the best form of conveyance is the contrivance like a handbarrow, stretcher or ladder shown in the plate carried by two men.

When it is used, each branch as it is cut is laid with the cutting hook directly across it, care being taken that the cut ends are all in one direction. When it is loaded, it is carried direct to the burning shed and turned over so that it lies in a heap with the cut ends towards the burner, ready for picking up branch by branch for burning. If the pear is thrown down in an irregular heap, the burner wastes a great deal of time picking out branches and getting hold of them in proper way.

If the pear is to be burnt on a hearth, the branches should be cut into pieces of suitable size for burning before they are loaded on the carrier or cart. For burning with lamps the branches may be of any size.

The pear should be loaded lightly. When the branches are pressed heavily together, the thorns of one go right into the leaves or woody part of the other and break off. These embeded thorns are not destroyed by burning and as a precaution some users split each leaf open before chopping in order to detect them. No such precaution has ever been taken at Dhond or Poona and no trouble has ensued; but Mr. Beyts found many instances in Nagar District of cattle injured by such stray thorns.

Possibly the explanation may be that at that time the pear was always cut very small in Nagar and the cattle may have swallowed the stuff without chewing it sufficiently to feel and get rid of the thorns.

B u r n i n g .

G E N E R A L .

The requirements of an effective system of burning are—

- (1) The large thorns must be completely burnt.
- (2) The small tufts of thorns must be scorched and rendered harmless.
- (3) The leaves should not be burnt at all.
- (4) The leaves should not be smoked.
- (5) For economy the thorns should, as far as possible, be made to burn themselves.

So long as the large thorns are completely burnt and the tufts of small thorns at the root of the large thorns are thoroughly blackened and scorched, these tufts of fine hairlike thorns do no harm to the animals which eat the pear. If the fine thorns are left untouched by the flame they may do harm causing soreness of the mouth and irritation of the stomach and bowels. Ordinarily careful burning will render them quite harmless.

To obtain these results a clear hot flame is needed without the necessity of keeping the pear for long close to a hot fire.

The ideal method is the use of an oil blow lamp which produces exactly the flame required with no hot fire at all. If lamps were obtainable at a cheap rate, oil cheap and plentiful and the people who have to use them intelligent enough to keep them in good order there would be no question of using any other. As it is, it is difficult to get lamps at all and impossible to get them cheap, oil supply is a difficulty and many cultivators are not to be trusted to use them properly or keep them in order.

The next best method is the use of a smith's fire with any ordinary blower and light dry wood. For smith's work what is wanted is an intensely hot fire and no flame. What is wanted for prickly-pear burning is as little fire as possible and a large mass of clear flame. Hence although the hearth and bellows used are the same they must be used in a different way. For smith's work charcoal coke or coal is the best and light wood is useless. For prickly-pear light wood sticks and rubbish are the best and the others, even good fuel wood, are much less effective. The whole success of the method depends on the way in which it is worked. The maintaining of a steady blast neither too strong nor too weak, the feeding on of wood at the right rate and in the proper place over the blowing nozzle according to the kind which is used, and the holding of the prickly-pear in exactly the proper way over the flame

and its removal the moment it is sufficiently burnt are things which have to be very carefully taught and learnt. A good gang of men can prepare 2,400 lbs a day with the same equipment with which an untrained lot will turn out only 400. These are figures of actual cases. It is for this reason that the instructions which follow are given in such detail.

The burning of the thorns should be done in a shed protected from the wind. The wind prevents the oil blow lamps from burning properly, or blows the flame of the *lohar's* fire aside and does not allow the flame to burn steadily up the pear branches. A moveable screen of *chattai* is useful where the direction of wind is always changing.

For the use of private owners and in small villages, the best equipment is a pair of skin blowers with tongs, etc., costing in all about Rs. 15, or if the owner is sufficiently intelligent to use it, a blow lamp and hooks costing about Rs. 40.

In Ahmednagar a rotary blower manufactured at the American humen and costing about Rs. 20 has been used with success; but the supply cannot be guaranteed meanwhile. It has just been tested at Kirkee and found to be more efficient and more economical than any other blower or bellows.

Burning with Hearths.

WORKING OF HEARths.

Flame required—

There should be a mass of clear white flame about a foot high and a foot or 18 inches across with no smoke and no smoky yellow flame. It should not be blown so hard as to produce a small intense colourless flame like that of a charcoal forge fire.

Fuel—

The best fuel consists of small sticks, thorns, dried tarwad bush or any light dry wood broken up into pieces about 6 to 8 inches long.

If ordinary fuel wood is used it should be split up into pieces, 6 to 8 inches long and not more than 1 to $1\frac{1}{2}$ inches thick and should be thoroughly dry. Fresh or green wood, is not good nor is any wood which gives a smoky flame.

Coks coal or charcoal is expensive and not nearly so effective.

Feeding fire—

The fire should be fed with handfuls of small wood constantly and there should never be more than about half a dozen pieces on it burning at once. Workmen always tend to make a fire much larger than necessary and so waste fuel and make it hot and uncomfortable for those engaged in burning.

Working of double bellows—

The best blast is obtained by long slow sweeping strokes of the handle. The strength of the blast can be varied by weighting the upper board. Usually one or two country bricks added give about the proper blast. The weight hanging from the chain to the lower board should be less than that usually used by *lohars*. Blowers should not be allowed to tie a rope on to the end of the handle and sit down and pull with short jerky strokes as they always will do if not watched.

NOTE— The fuel should be brought to the hearth ready cut to the right size.

In hearths with grates, fuel, if small enough, can be thrown through the grate. Otherwise it must be shoved in below the grate, a gap being left in the front wall of the hearth for the purpose.

BURNING.

The best arrangement for the supply of unburnt pear and disposal of the burnt pear is indicated in the plan of the model burning shod. One burner should stand at each side of the hearth, the blower should stand in front and feed the fire with wood. The unburnt pear should be in two heaps in front of the hearth beside the two burners and the burnt pear should be thrown across to two heaps behind ready to be carried away.

The branches of the pear should not be over 2 or $2\frac{1}{2}$ feet long or too much branched. Larger pieces are too heavy to handle and if they are much branched a great deal of time is wasted in turning them over and to secure burning of all corners of leaves.

In burning, the branch is gripped by the thick end with the tongs almost at right angles to the stalk and held obliquely over the flame till the whole of the thorns are completely burnt. It is then turned over with the other side down in the same way. If properly held, as soon as the thorns on the lower leaves are thoroughly alight, the whole branch flares up and is completely burnt in two or three seconds. The branch is then moved about so as to burn any portions which are left. Finally the grip of the tongs must be changed and the thorns round about that place burnt. Burners must be taught to turn over the branch and change the grip of the tongs quickly as a knock; otherwise they will waste half of their time doing it. When the burning is complete the pear should be tossed to the rear.

/exp'N Burning with Blow Lamps.

BURNING.

The most effective portion of the blow lamp flame for burning thorns is 4 to 6 inches away from the nozzle.

The following is the best method :—

(1) The branch which may be from 2 to 4 feet long is hung from the hook leaves downward. The lowest part of the branch should be about 18 inches above the ground. Burning is begun at the lowest point of the branch; the flame of the lamp directed upwards at angle of 45° along the flat of the leaf from the edge and not perpendicular to the flat side of the leaf. Once the thorns at the bottom have begun to burn they set fire to those above and the whole branch flares up, burning up most of the thorns. Those which still remain unburnt have to be gone over and burnt bit by bit with the flame of the lamp. Two hooks should be used and a branch should be kept ready on the second hook by the helper so that the use of the lamp can go on continuously and thus economise time and trouble. Another method is to hang a number of branches (up to half a dozen) on the hook, burn from below and so set fire to the whole lot, then finish them off branch by branch with the lamp.

It may be better to have two lamps to do the original burning in this case.

USE AND CARE OF LAMPS.

Oil.—All oil used should be filtered through cotton waste or wool. In a camp the oil should be filtered from one tin into another and the clean oil poured in directly with a measure. Filtering, while filling into the lamps (which have to be refilled half a dozen times a day) wastes time.

Kind of oil.—For Primus type lamps with coil tube burner, white oil should be used.

For Richardson and Cruddas lamps either white or red can be used.

Crude oil cannot be used in any of the types at present available.

Use.—Primus type—

- (1) Burner should be thoroughly heated before pumping up or opening the needle valve in lamps fitted with valves (e.g., Petrolia).
- (2) The nipple should be cleaned with the priker every time the lamp is lit before lighting as a matter of routine.
- (3) After some weeks' use, the coil tube may become choked up with carbon and dirt. It must then be burnt out. This can only be done at centres like Poona or Bombay. When a lamp ceases to burn properly even when the nipple is clear, it should be returned to store for repair.

- (4) If pressure falls rapidly probably something is wrong with the pump valve. Lamps going wrong in this way should be sent back to Poona or kept to be repaired by some expert workman visiting the camp.

Richardson and Cruddas lamp—

The burner requires to be heated for longer before starting than the Primus type and does not work properly until the blow flame itself has been burning for two or three minutes. As it is heated with a kerosene torch the body of the burner gets coated with a thick layer of soot and it is only when this has been burnt off again that it burns perfectly. The tube of the burner can be heated up quickly by deflecting the flame upwards with the piece of tin supplied.

The burner should only be taken apart for cleaning by a skilled workman.

Where more than one blow lamp is in use only the first need be started with torch or methylated spirits. The burner of lamps subsequently lit can be heated up in the flame of the first lamp.

Chopping.

After burning the pear has to be chopped up fine for the first week's feeding and fairly small for the second. After that cattle will almost eat whole leaves but it is better to cut it up (say one leaf into 4 to 8 pieces) especially for mixing with cotton seed.

There are two methods—

(1) With chaff-cutter.—Any rotary chaff-cutter will do. When preparing for cattle just commencing prickly-pear feeding the mechanical feed should be adjusted to cut as small as possible. For ordinary fodder it should be adjusted to cut as long as possible. A chaff-cutter will cut 500 lbs. per hour. (2) When chaff-cutters are not available the hand choppers must be resorted to. Hand choppers have been prepared as per illustration. A solid chopping block of *babul* or other hard wood sufficiently large, not too light and steady is wanted. It should have a large flat surface. If the leaves are thin they may be piled up 5 or 6 deep. A chopper will cut through the mass. This method has been adopted as the best by men doing the work at Kirkee and elsewhere. A good cutter will chop over 400 lbs. per hour.

Care should be taken that the pear choppers are not spoilt by being used for cutting wood. Labourers will always utilise them for this purpose if not watched.

When cattle are beginning to eat prickly-pear fodder for the first few days, it is a good plan to chaff a little *karbi* or grass with the pear and to sprinkle with flour during the chaffing in order to thoroughly mix the food so that cattle cannot separate the ingredients.

As the pear is moist it must be kept clean from earth and sand after it is burnt and until fed. In order to secure this, the place where the burnt pear is thrown after burning, should be rammed and smeared like a threshing floor and kept swept clean. This should also be done round the chopping blocks. If possible it is a good thing to have galvanised sheets on which to store the chopped prickly-pear, or pieces of *chattai* which should be put out in the sun daily to keep them sweet.

Choice, cost and supply of equipment.

LAMPS.

The only lamps obtainable in large quantities now are those manufactured to our design by Messrs. Richardson and Cruddas, Byculla Ironworks, Bombay, with Edgley patent burners.

Three hundred and fifty have been ordered by Government for supply to districts. They cost Rs. 38 and can be obtained by ordering direct from the makers, bills for the cost being sent to the Collector of Poona who will recover it from the officers supplied.

A few of the old standard lamps of the Primus Company of the larger sizes, which are equally good or better, are still obtainable on the market but only at high prices (about Rs. 55 to Rs. 80).

Hearths—These are made of ordinary brick.

Gratings—After a sample has been obtained, can be copied by local *lohars*. Hearths can be used without gratings; but with gratings there is less overburning and soiling of the pear with ash, etc., and the output is much greater.

If the large grate is not available it is an advantage to have a grate of three bars about 6 inches apart immediately over the fire.

		English made.	Local.
		Rs.	Rs.
<i>Bellows</i> —Cost, English double bellows 2 feet 6 inches	...	105	50
2 „	...	75	35
1 „ 6 „	...	55	25
Pairs of skin blowers	...	8	

The prices given are those current in Poona and Bombay except the skin blowers which are prepared in Bombay.

English made bellows are almost unobtainable in Bombay now.

The size used at Kirkee is 2 feet 6 inches, but 2 feet gives almost as good results and 1 foot 6 inches is quite effective.

In a village where there is a *lohar* or *ghisadi* his forge can be utilised. For a camp, double bellows are best. For private owner's use, double skin bellows are the most convenient and cheapest, and a supply of them ready for use should be kept for issuing to cultivators.

Tongs—The design of these is very important and in the first instance they should be obtained from Poona and afterwards, if possible, copied accurately locally. The spring is a great convenience but is difficult to fit and is not essential.

Pitchfork—The heavy design given is recommended for driving into the branches of pear and balancing in carrying.

All applications for model equipments or for samples of any of the implements marked in the list should be addressed to the—

Prickly-pear Department, Agricultural College, Kirkee, Poona.

All the prices given in the statement of equipment appended are very high—

- (1) because of the general rise in the price of iron,
- (2) because the articles have been specially prepared in Bombay on urgent orders.

In some cases the prices paid are 50 per cent. over tender rates for later delivery. On the other hand it has been found to be almost impossible to have them prepared satisfactorily in any quantity locally. Probably most of the implements could be made locally at about half the rates given, but it is strongly recommended that, in spite of this, model equipments should be obtained in the first instance as samples from Kirkee to avoid delay.

Camps.

Locality—

A camp or centre should be situated where there is an absolute dearth of fodder either grass or irrigated crops. So long as the people see that ordinary fodder is still apparently obtainable on some terms and by some means, they will be very reluctant to have anything to do with prickly-pear.

The best advertisement of the fodder is the presence of a number of the cattle from the village in which the camp is situated.

Selection of site—

Shade—

Cattle are only tied up while they are being fed. Hence it is not essential that the actual camp site should have either natural or artificial shade; although it is of course an advantage.

It is very desirable however that there should be good natural shade in the vicinity of the camp where the cattle can pass the heat of the day.

It is of course also an advantage to have the burning sheds in good shade for the comfort of the workers.

Water-supply—

There should be abundant supply of good water within easy distance say within a mile. It is not necessary that the water-supply should be actually at the camp site.

When the supply of water ceases to be adequate, the camp should be moved. A river-side site is best.

Prickly-pear—

The best kind grows on low ground and on good soil. That which is found often in large quantities on poor rocky ground is poor, dry and very thickly covered with thorns.

Prickly-pear is bulky and rather difficult to carry. Hence it is essential that there should be abundant supplies in the immediate vicinity of the camp.

Communications—

Loaded carts should be able to come right up to the camp with supplies and it should be within convenient distance of the centres from which oil, grass and cotton seed are obtained. It is an advantage to have it at or near a main road and near a bazar so that it may be seen and visited by the maximum number of people.

In the beginning the work requires constant checking and supervision and it is an advantage if it is easily accessible to inspecting officers. After the first few demonstration camps are well started and the people themselves become familiar with the work this is less important.

Fuel—Where hearths are used instead of lamps a good supply of wood in the immediate vicinity is needed.

GENERAL ARRANGEMENTS.

The guiding principles in laying out and working camps are:—

- (1) That the carrying out of each operation should be made as easy as possible.
- (2) That no one operation should interfere with any other.
- (3) That no one should require to stop work to allow another to pass.
- (4) That no one should have to wait for anything he requires. Thus carriers bringing pear for burning or taking away the burnt pear for chopping, or chopped pear for feeding must have clear paths from point to point in the sheds so that they will not interrupt the blowers or choppers in their work.

There should always be a supply of pear on each side of a hearth ready for burning and a supply of burnt pear beside each chopper for chopping. At the time fixed for making up feeds there must be a sufficient amount of chopped pear, grass and sarki ready.

These suggestions may seem superfluous, but as a matter of fact in a badly run camp the men spend a considerable part of their time getting out of each others way, waiting for each other and doing for themselves what ought to have been done for them by some one else. In a camp laid out like the model camps at Kirkee and elsewhere, the work can be carried on with no avoidable waste of time or misdirection of energy. (See plan of camp and sheds.)

Bellows and hearth or burning hooks should be arranged in lines with ample space between each pair to leave the burners to work in, and with ample space in front for the loads of pear to pass and behind for the loads of burnt pear to be taken away.

The chopping place should be at one end or behind the line of burning places and should be near the feeding lines.

SELECTION OF CATTLE FOR ADMISSION TO CAMPS OR PURCHASE.

Cattle should be selected by professional agency (Agricultural Department or C. V. D.), or by local Revenue officers with the assistance and advice of intelligent cultivators or by local camp or village committees, provisionally, subject to confirmation by a Veterinary officer.

In camps to which full Government assistance is to be given the following principles should be observed :—

(1) *Quarantine*.—As each new batch of animals is admitted it must be kept for a time apart from the main camp under observation in quarantine.

(2) *Qualifications for admission*—

(a) Age—Bullocks under ... 10

Cows ... 8

Buffaloes ... 8

Young stock ... No age restriction.

(b) Size.—Adult animals should be of useful size as working animals or breeders.

(3) *Grounds for rejection*—

(a) Extreme weakness, a simple test being whether the animal is unable to rise without assistance.

(b) Diarrhoea

(c) Cough

(d) Running at eyes.

Animals should be classed.—

(1) According to size, large (for Deccan) ... over 52 inches.

medium ... 44 to 52 "

small ... below 44 "

(2) According to the time for which they have been on prickly-pear diet—

first period,

second "

full diet.

The duration of these periods will vary according to the original condition and progress of the animal but will generally be of a week or 10 days.

Animals purchased or taken charge of for maintenance should be branded on the horn with serial number in the admission register. Brands on the hoof disappear with growth after some weeks and large brands on the shoulder spoil the hide.

In Nagar purchase price is branded on the horn but this information is recorded in the register.

FEEDING.

Animals should be tied in lines with ropes according to classes. A long rope दावण should be securely staked down, with stakes firmly fixed in the ground at intervals of not more than 15 to 18 feet, neck-ropes दावे are tied to this at such intervals that the animals cannot interfere with each other while feeding.

Six feet between animals will usually be sufficient. For the same reason weak and powerful animals should not be tied up together.

The best feeding dishes are iron *ghamelas* or sheet iron trays, but as these are expensive and not always available, round locally made baskets of cotton or tur stalk or bamboo should be used. They should not be smeared and should be occasionally washed.

MEASUREMENTS OF RATIONS.

Prickly-pear can be measured out accurately enough by eye in the *ghamela* or basket.

Grass can be most conveniently rationed by weighing out enough for a group or line of cattle and dividing it up equally by eye.

Cotton seed should be measured with a special tin measure for each animal or by double handfuls under strict supervision, or measured out for a batch of animals, and thoroughly mixed up with the ration of prickly-pear for the batch which can then be divided up like prickly-pear alone.

Without careful supervision attendants will always get hold of more than their share of cotton seed for the animals in their charge, especially if they are themselves the owners or owners' private servants.

Prickly-pear and cotton seed or any concentrate such as oilcake used, should be fed mixed thoroughly together.

Grass should be fed separately except to cattle which are being trained to eat prickly-pear. For them the grass and prickly-pear should be chopped up together.

The rations recommended by the Agricultural Department are given in the tabular statement appended.

These are full rations containing a normal amount of nutriment and sufficient to restore animals in poor condition to normal flesh.

If any of the ingredients is not obtainable an equivalent amount of some other food must be substituted—

1 lb cotton seed is equivalent to 2½ lbs grass.

" " " 1 lb gram.

" " " $\frac{1}{2}$ lb oilcake.

The rations recommended in Nagar are slightly different. Either system is satisfactory so long as it is adhered to steadily.

Suggestions as to initiation of work.

The best method of convincing people of the value and unobjectionableness of prickly-pear as fodder is for the Collector or Prant officer or an officer of the Agricultural Department to visit the village, personally demonstrate the preparation of prickly-pear with lamp and hearth and actually have cattle fed with the prickly-pear prepared in the presence of the villagers, explain briefly the advantages and difficulties of the system and then arrange with a few of the most influential villagers to visit a place where the system is actually working, e.g., Ahmednagar, Rev. A Norton's Farm at Dhond, Dairy Farm Kirkee, Bhamburda, Manjri or any thoroughly established camp. Ahmednagar, Dhond and Kirkee are the best places because, there, enquirers can be sure of having any difficulties explained.

After this, some of the villagers should be induced to send a certain number of cattle with men in charge to an established camp to have the cattle trained to eat prickly-pear and to have the men trained in preparation and feeding.

If they are willing to do so, they should be asked at once to send some men independently to be taught at a camp where there are arrangements for training for four days.

When this has been done and a sufficient number of villagers agree to use the system a complete equipment should be sent to the village with a trained demonstrator to work it for a week or so. It can then be handed over to the local committee for working.

Great harm is done if irresponsible or insufficiently trained persons are allowed to do propaganda work in the first instance.

The whole movement is apt to be discredited if people start trying to use it without sufficient knowledge of methods of preparation and system of dieting and habituation of cattle.

People can be induced to take to cactus feeding only by the most strenuous and persistent work on the part of District officers themselves.

District organisation.

When there is a widespread fodder famine it is useless to attempt to cope with it as a whole through camps.

The people must be taught to make their own arrangements and the principal object of a cactus fodder campaign should be to instruct the cultivators and induce them to take up the work themselves.

The smallest equipment can turn out enough fodder for about 50 cattle. The fodder can either be prepared and taken away by owners for feeding to their cattle, or the cattle can be brought to be fed at the place where the cactus is prepared.

Either arrangement or a combination of both can be used both at large camps and where villagers do the work themselves.

Feeding together at the place where the fodder is prepared is best, because dieting is very important when cattle are being taught to eat and owners cannot be trusted to do it properly without constant supervision or guidance. After cattle are habituated to the fodder there is of course no objection to owners taking away what they require, but they are more likely to conform to the system of rationing if feeding is carried on under the routine of a camp.

Camps may either be—

(1) Maintenance camps for animals purchased by Government, charitable funds or local committees to be fed till the rains and then resold for cash or on *tagai* advances on the model of the Ahmedabad District Camps.

(2) Maintenance camps for boarders where owners can send their cattle to be fed on payment of a monthly rate.

(3) Instructional camps to which owners can bring their cattle or send them with servants to have the cattle broken to the new diet, and to learn the methods of preparation and feeding.

(4) Depots for the preparation and free distribution and sale of burnt cactus or mixed fodder consisting of cactus with the proper proportion of cotton seed

or a combination of any of these.

The system in Nagar is to have instructional camps at Taluka headquarters and on the main roads by which cattle return from the ghat grazing grounds and to get the villagers to organize village camps and depots for themselves.

At the instructional camps any owner can send or bring his cattle of any kind to be trained and fed free for the first few weeks. After this period he can either leave the cattle and pay for them as boarders or take them back to his village furnished with an equipment for doing the work himself.

The expenses of these camps are borne entirely by Government, the labourers employed being treated as on famine relief work, and the equipment and running costs for oil, fuel and cotton seed being met from special Government grants for cactus fodder work.

At all these camps prepared fodder is freely distributed to passing cartmen or drivers for advertising purposes, and sold to local owners who prefer getting the fodder in this way to preparing it for themselves.

In Poona the Agricultural Department are running half a dozen camps in which it is proposed to maintain about 2,000 cattle purchased in local markets on a mixed diet of cactus cotton seed and fodder crops grown on the Government farms. Till this number is made up boarders are taken for instructional purposes at the rate of Rs. 4 per month.

Besides these there are about a dozen camps at centres in the worst affected talukas run on the same principles as the Nagar instructional camps, which are provided with equipment by Government, and financed partly from a special Government grant, partly from local subscriptions, partly by grants from the District Famine Relief Committee, and partly from receipts from sale of fodder and boarding charges.

The extent to which Government and charitable funds should contribute is a question to be decided according to the urgency of the work of propaganda.

Villages are assisted in Nagar and Poona by free loan of equipment by employing labourers as on famine relief work, by assistance in obtaining fuel supplies and by advances of *tagai* on joint bond.

General considerations.

Famine grass at present, with cartage, costs the cattle owner (say) Rs. 18 per 1,000 and costs Government Rs. 12 per 1,000 in addition. At least 10 lbs a day per head is needed or 300 lbs per month costing the owner Rs. 5-7 and Government Rs. 3-10 or roughly in all Rs. 9.

Cactus fodder may cost about Rs. 4 a head for an equally good diet out of which Government need only spend Rs. 2 even if the cotton seed required is given free. It thus costs Government much less to supply cotton seed free than to issue famine grass at Rs. 15 per 1,000.

Examination of the three statements attached will show—

- (1) That the cost for equipment per head is trifling.
- (2) That the greater part of the cost of the rations used is for grass and cotton seed. The cost of cactus is only at most about Rs. 2-8 per head per month.
- (3) That $\frac{3}{4}$ of the cost of preparation of cactus is for labour.

Well-to-do owners can always pay for cotton seed, fuel and labour themselves either in cash or by taking *tagai* advances in which case the only expense incurred by Government is for equipment and supervising agency.

The number of cattle being fed wholly or partly on cactus is now over 15,000 in Nagar District and about 2,000 in Poona.

Running Expenses.

Work.	Post	Rate.	Private.	Unit of 50	Camp of 500.
STATE.		Rs. A.	Rs. A.	Rs. A.	Rs. A.
Lamp	Superintendent ..	1 0			
	Head burner ..	1 0			
	Second burners ..	0 8	2 1 0	2 1 3	1 10 5 0
	Others ..	0 6	... 1 0	6 10	3 12
	Total ..	...	2 1 0 3	1 6 21	9 12
Hearth	Head burner ..	1 0	... ...	... ...	1 1 0
	Second burners ..	0 8	... ...	2 1 0	10 5 0
	Others ..	0 6	2 0 12	... ...	10 3 12
	Blowers ..	0 6	1 0 6	1 0 6	10 3 12
	Total ..	...	3 1 2 3	1 6 31	13 8
	Carriers ..	0 6	1 0 6	1 0 6	10 3 12
	Choppers ..	0 6	1 0 6	1 0 6	10 3 12
	Feeders ..	0 6	... ...	1 0 6	10 3 12
	Herdsmen ..	0 6	... ...	1 0 6	10 3 12
	Reserve ..	0 6	... ...	1 0 6	10 3 12
	Total ..	...	0 12	1 14	18 12
Fuel	Oil	12 gallons	1 0 12	1 0 12	9 0
	Firewood	8 maunds	3 1 8 3	1 8 25	12 8
Total for lamps	...	...	2 8	4 4	37 8
" hearths	...	...	3 6	4 12	44 12
Per 1,000 lbs lamps	...	...	2 0	2 14	2 8
Per 1,000 lbs hearths	...	...	2 12	3 2	3 0
Per animal per day lamps	...	...	Rs. A. P.	Rs. A. P.	Rs. A. P.
Per animal per day hearths	...	...	0 0 10	0 1 4	0 1 3
Per animal per month lamps	...	...	Rs. A.	Rs. A.	Rs. A.
Per animal per month hearths	...	...	1 8	2 9	2 4
	...	...	1 14	2 14	2 11

Rations.

Rations for medium sized animals with cost based on following rates.
Cost calculated in following rates:—

Cactus	...	...	3 annas 4 pies per 100 lbs.
Cotton seed	...	...	16 lbs per rupee.
Grass	...	...	(A) Concession rate Rs. 15 per 1,000 (B) Actual cost about Rs. 30 per 1,000

(1) Full daily rations used in *Agricultural Department Camps in Poona District*—

- (A) With grass at Rs. 15 per 1,000
(B) " " 30 per 1,000

(2) Rations used in Ahmednagar District—

Period.	Cactus		Cotton seed.		Grass.		Total		Per month.
	Amount.	Cost.	Amount.	Cost.	Amount.	Cost.	Amount.	Cost.	
(1) Poona	mount.	Cost.	Amount.	Cost.	Amount.	Cost.	Amount.	Cost.	Cost.
	A. 1st	10	0 0 4	2	0 2 0	10	2 6	22	4 10 R. 9 1
	B. "	20	0 0 8	" 1	0 1 6	" 8	5 0	"	7 4 R. 15 0
	A. 2nd	"	"	"	"	"	2 0	20	4 2 R. 7 13
	B. "	"	"	"	"	"	4 0	"	6 2 R. 11 9
	A. 3rd	30	0 1 0	1	0 1 6	4	1 0	32	3 0 R. 5 10
	B. ...	...	...	...	...	2 0	...	4 0	R. 7 8
(2) Ahmed-nagar	1st	6	0 0 2	2	0 2 0	*None.		8	2 2 R. 4 2 3
	2nd	12	0 0 6	2	0 2 0	*None.		14	2 5 R. 4 8 6
	3rd	21	0 0 10	1	0 0 6	24		1 4	2 8 0

*Two lbs a day of grass added when there is no grazing of any kind.

This will add about six pies per day or 14-6 a month at Rs. 15 per 1,000, one anna a day or Re. 1-13 a month for each animal at Rs. 30 per 1,000.

Total amount required and cost for a working camp of 500 per month in Poona assuming that animals are on an average medium and that all remain for first week on first ration and second on second ration grass at Rs. 15—

	Number.	Prickly-pear.	Cotton seed.	Grass.	Total weight.
First ...	120	1,200	2 8	240	16 0
Second ...	120	2,400	5 0	180	11 4
Third ...	260	6,500	13 88	260	16 4
Total per day ...	500	10,100	21 1	880	42 8
Per month cost ...	...	3,03,000 R.	632	20,400 R.	1,275 96,000 R.
					1,440 3,317 0

All these figures are to be reduced by 50 per cent. for 'small' animals and increased by 50 per cent. for large.

When any of the constituents of the ration are not available an additional equivalent of another concentrate may be substituted—

One lb cotton seed is roughly equivalent to $2\frac{1}{2}$ lbs grass.

$1\frac{1}{2}$ lb gram.

$\frac{1}{2}$ lb oilcake.

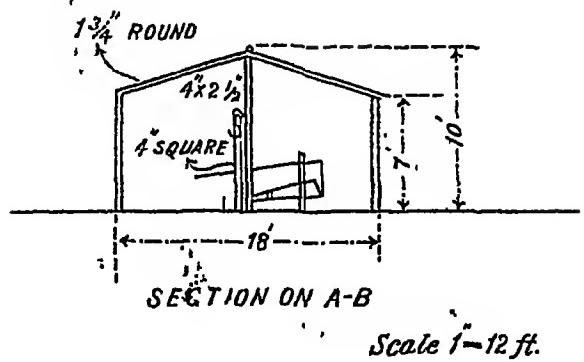
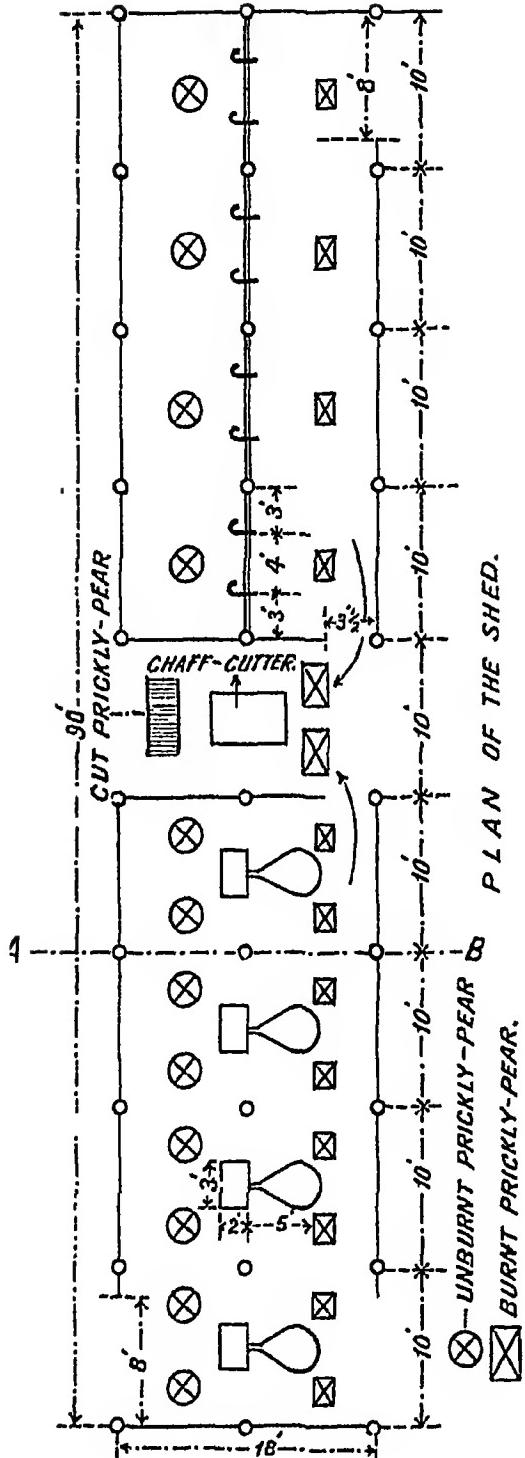
One lb grass , , , $\frac{2}{5}$ lb cotton seed or gram.

$\frac{1}{5}$ lb oilcake.

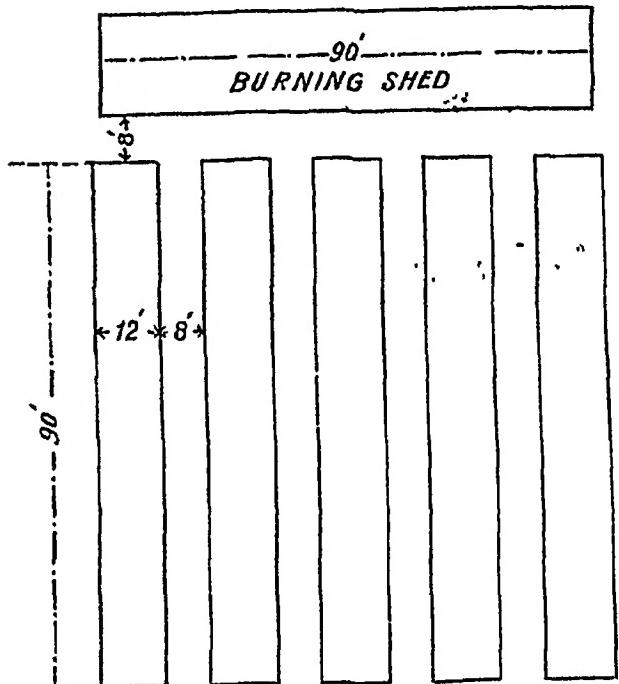
Equipment.

Work.	Articles.	PRICES.			TOTAL COST.					
		EACH.			For private use 25-50		For Camp Unit of 50.		For Camp of 500.	
		Kirkee Depot.	Probable local.	Selected in estimates.	No.	Cost.	No.	Cost.	No.	Cost.
		Rs. A.	Rs. A.	Rs. A.	Rs. A.		Rs. A.		Rs. A.	
Burning (Lamps)	Lamp (1) ...	38 0								
	Primus (2) ...	60 0	60 0	60 0	2	76 0	3	114 0	20	760 0
	Lamp (Edgley) ...	38 0	...	38 0	1	0 12	4	3 0	40	30 0
	Hook ...	0 12	0 12	0 12						
	Oil drum ...	10 0	6 0	6 0						
	Oil tin ...	1 0	1 0	...	2	1 0	1	1 0	2	2 0
	Fitter ...	0 3	0 3	...	1	0 3	1	0 3	2	0 12
	Filters ...	0 1	0 1	...	1	0 1	1	0 1	4	0 4
	Measure ...	0 4	0 4	...						
	Tool chest ...	10 0	5 0	...						
	Tongs ...	5 4	2 0	...	1	2 0	1	2 0	4	8 0
	Total ...	...	...	...	80 0	...	120 8	...	823 8	
Burning (Hearths)	Bellows—									
	English 2'-6" ...	125 0								
	2'-0" ...	90 0								
	1'-6" ...	70 0								
	Local 2'-6" ...	50 0	40 0	50 0	...	...	1	50 0	10	500 0
	2'-0" ...	35 0	25 0	...						
	1'-6" ...	25 0	18 0	...						
	Fittings ...	10 0	7 8	7 8	...	1	7 8	10	75 0	
	Skin blowers ...	8 0	...	...	1	8 0	1	8 0	12	6 0
	Rotary fan ...	18 0								
	Tongs ...	5 4	2 0	2 0	2	4 0	8	6 0	25	50 0
	Poker ...	0 10	0 8	0 8	1	0 8	1	0 8	12	6 0
	Chopping block ...	0 8	...	0 8	...	1	0 8	4	2 0	
	Wood chopper ...	2 4	1 4	1 4	1	1 4	1	1 4	4	5 0
	Total ...	...	...	...	13 12	...	65 12	...	638 0	
Cutting ..	Carrier ...	0 10	0 10	0 10	1	0 10	1	0 10	10	6 4
	Pitchfork ...	2 12	1 0	1 0	1	1 0	1	1 0	10	10 0
	Cutter ...	3 0	1 8	1 8	1	1 8	1	1 8	10	15 0
Chopping ...	Chaff cutter ...	180 0								
	Chopper ...	2 12	1 8	1 8	1	1 8	1	1 8	10	15 0
	Block ...	0 8	...	0 8	1	0 8	1	0 8	10	5 0
Feeding ...	Ghamelias ...	1 8	1 4	1 4	4	5 0	4	5 0	20	25 0
	Baskets ...	0 4	0 2	1 4	15	1 14	15	1 14	150	18 12
	Measures (set) ...	0 6	0 6	0 6	1	0 6	1	0 6	2	0 12
	Total ...	...	...	...	12 6	...	112 6	...	95 12	
Total (Lamps) ...	...	...	...	...	92 0	...	132 14	...	919 4	
Total (Hearth) ...	...	...	...	...	26 2	...	78 2	...	733 12	
Outturn daily ...	...	...	...	...	1,200	...	1,500	...	15,000	
Cost per head ...	Lamp ...	...	...	...	2 5	...	2 10	...	1 13	
Cost per 1,000 lbs daily outturn.	Hearth ...	...	...	...	76 0	...	88 0	...	1 8	
	Lamp ...	...	...	...	21 10	...	52 0	...	61 4	
	Hearth ...	...	...	...	...	...	...	...	49 0	

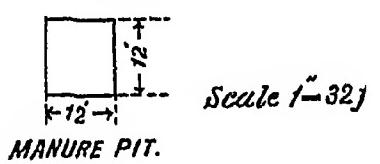
PLAN OF BURNING-SHED & CAMP



Scale 1"-12 ft.

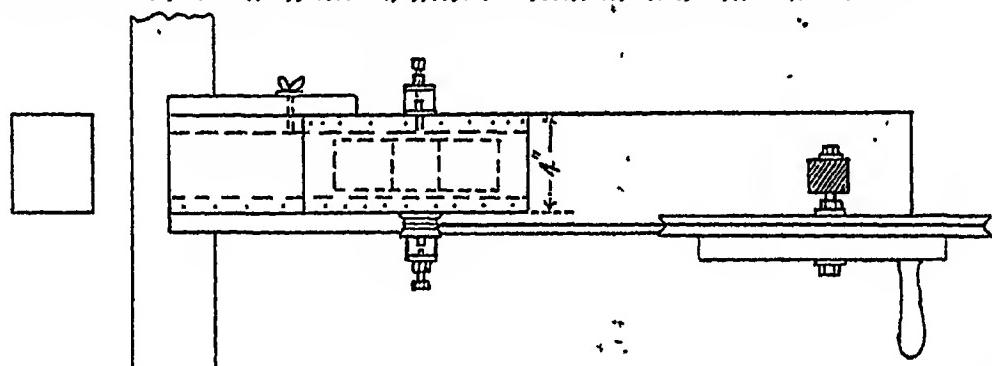
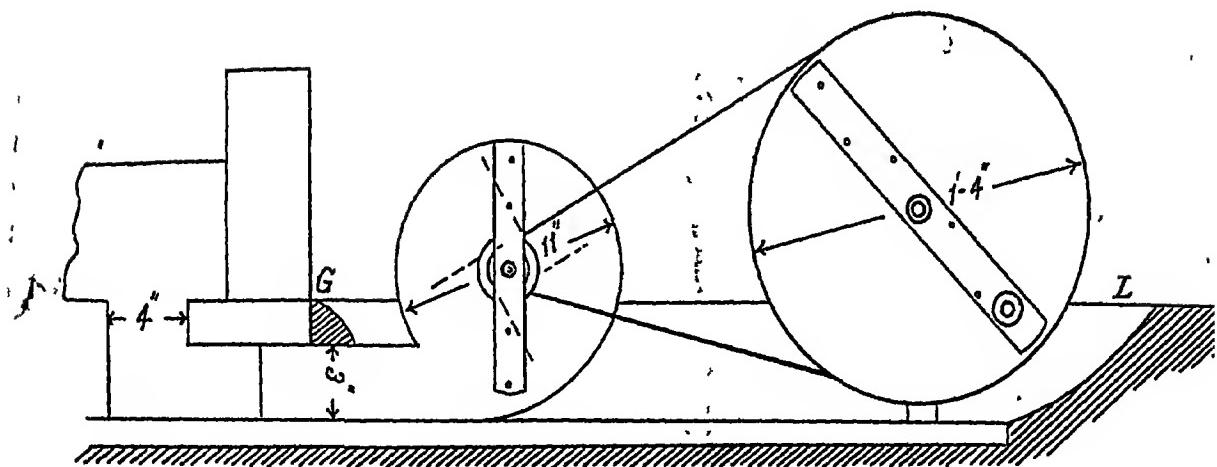


5 DOUBLE LINES 18 CATTLE IN EACH

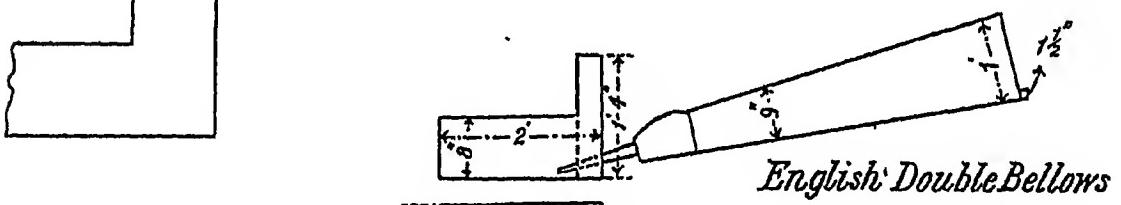


Scale 1"-32J

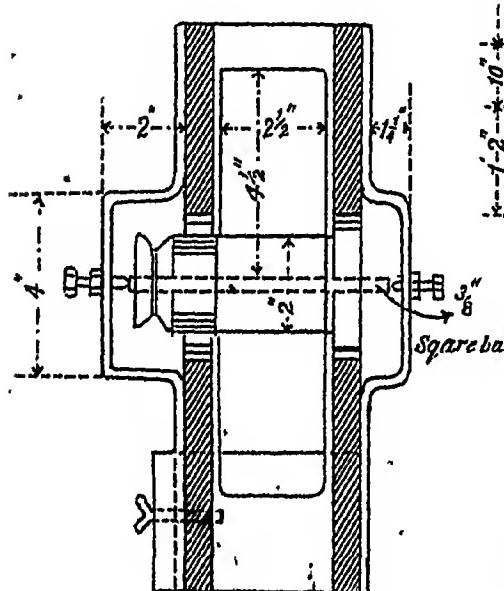
EVANS ROTARY BLOWER



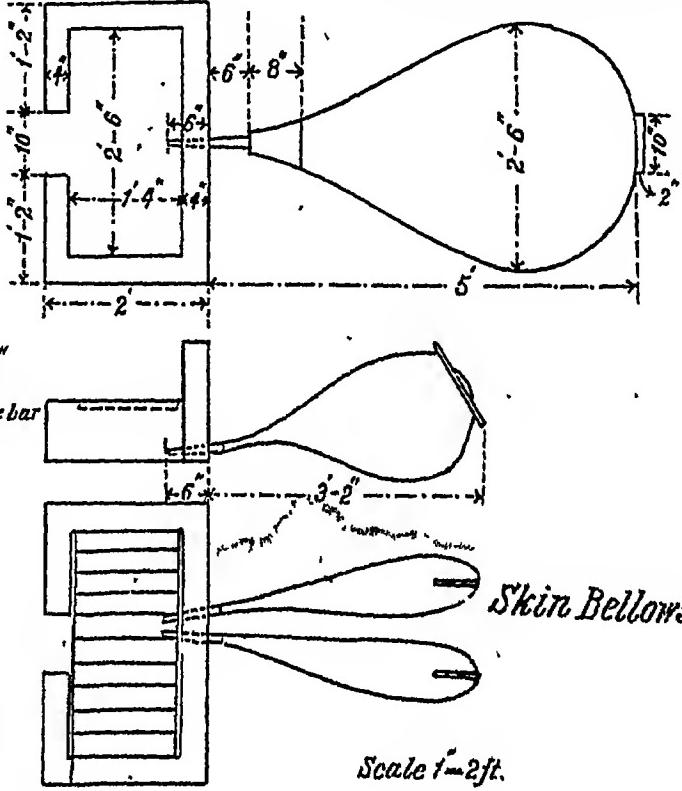
Scale 1-1/2 ft.



English Double Bellows



Scale 1-0 ft.



Skin Bellows

Scale 1-2 ft.

TOOLS

